

# Hydrogen Technology Validation

## The Challenge of New Technology

Hydrogen fuel cells offer great promise for our energy future. Hydrogen fuel cell vehicles are not yet commercially available, however, and the infrastructure to refueling does not exist today. Research is making progress, but most hydrogen, fuel cell, and infrastructure technologies still require significant testing in real-world conditions before they will be ready to enter the commercial marketplace.

That's where technology validation comes in — once a technology achieves its targets in the laboratory, it must be evaluated as an integrated system, such as a hydrogen fueling station or hydrogen fuel cell vehicle. Technology validation does not certify marketability, but rather, it helps to manage research and development activities and refocus efforts as needed. The data collected will also help to develop statistical confidence that the systems meet customer expectations for cost, reliability, and durability.

## Technology Validation on a Large Scale: The National Hydrogen Learning Demonstration

In March 2005, the U.S. Department of Energy (DOE) announced the National Hydrogen Learning Demonstration, a unique collaboration of automobile and energy industry partners, their suppliers, and the federal government to evaluate hydrogen fuel cell vehicle and infrastructure technologies together in real-world conditions and assess technology readiness for the commercial market. Industry is providing half the cost of the demonstration, which is expected to total approximately \$380 million over five years.



BP hydrogen fueling station in Los Angeles, CA



Ford Motor Company's Focus fuel cell vehicle



A Hyundai fuel cell vehicle refuels at the Chevron hydrogen fueling station in Chino, CA



DaimlerChrysler's F-Cell fuel cell vehicle



A General Motors HydroGen3 fuel cell vehicle visits the Shell hydrogen and gasoline station in Washington, D.C.

Photo courtesy of Shell Hydrogen, LLC.

The learning demonstration will validate hydrogen fuel cell technology against targets for fuel cell durability and efficiency, vehicle range, and hydrogen fuel cost. It will also help ensure seamless integration of vehicle and infrastructure interfaces. The effort complements DOE's significant exploratory research and development efforts at universities, national laboratories, and with industry to address the hydrogen production, delivery, storage, and fuel cell technology challenges to achieving the vision of a hydrogen economy.

### Learning Demonstration Projects

The National Hydrogen Learning Demonstration projects currently involve the work of the following four teams employing fuel cell vehicles and hydrogen fueling stations to collect data both in controlled test conditions and on the open road in a variety of geographic areas and climates.

- ▶ Chevron Corporation is building hydrogen fueling stations in northern and southern California and in Michigan; Hyundai-Kia Motor Company is working in partnership with Chevron to test vehicles with fuel cells manufactured by United Technologies Corporation.
- ▶ DaimlerChrysler is testing vehicles with Ballard Power System's fuel cells; the vehicles will refuel at hydrogen stations built by project partner BP in northern and southern California and in Michigan.

- ▶ Ford Motor Company is testing vehicles with Ballard fuel cells; the vehicles will refuel at hydrogen stations built by project partner BP in northern California and Michigan, as well as Florida.
- ▶ General Motors Corporation (GM) is testing vehicles with its own fuel cell technology in partnership with Shell Hydrogen, LLC, which is building hydrogen fueling stations in several locations: New York, Detroit, California, and Washington, D.C.

### Project Outcomes

The National Hydrogen Learning Demonstration will help DOE guide its hydrogen and fuel cell component and materials research and may also uncover new technical challenges that have not yet been considered. By involving major stakeholders who will be responsible for bringing vehicle and energy technologies to consumers, the demonstration also provides a "real" environment for sharing of safety, codes, and standards issues across teams.

Because component data gathered in the demonstration will be obtained from an integrated system and under real operating conditions, stakeholders will have the information they need to validate DOE economic, energy, and environmental models/analyses, as well as technology status important to public benefit (vehicle fuel economy, fuel cell efficiency/durability, freeze start ability, hydrogen cost, and operating range).

As the demonstration proceeds, DOE officials will be able to communicate progress and risk to the public and Congress, and educate local communities and others about the hydrogen economy and the safe use of hydrogen.

### Did you know...

Hydrogen is an energy carrier, not an energy source, meaning that it stores and delivers energy in a usable form.

Hydrogen can be produced using abundant and diverse domestic energy resources, including fossil fuels, such as natural gas and coal; renewable energy resources, such as solar, wind, and biomass; and nuclear energy.

A hydrogen economy would not only reduce our dependence on imported oil, but also benefit the environment by reducing emissions of greenhouse gases and criteria pollutants that affect our air quality.

The President's Hydrogen Fuel Initiative accelerates the research and development of hydrogen, fuel cell, and infrastructure technologies that would enable hydrogen fuel cell vehicles to begin to reach the commercial market in the 2020 timeframe.

Under the President's Hydrogen Fuel Initiative, the DOE Hydrogen Program works with industry, academia, national laboratories, and other federal and international agencies to overcome critical technology barriers, address safety issues and facilitate the development of model codes and standards, validate hydrogen fuel cell technologies in real world conditions, and educate key stakeholders in the transition to a hydrogen economy.